

# COLD WORK STEELS

## Available Product Shapes

Flat Bar	Ground Flat	Long Products	Open Die Forgings	Plates
Round Bar	Round Ground Bar			

## Product Description

BÖHLER K890 MICROCLEAN – This powder-metallurgical cold-working steel has good toughness, very good compressive strength, and excellent fatigue strength.

## Properties

- > Toughness & Ductility: very high
- > Good toughness means safety against cracking of the molds in use: very high
- > Uniformly high strength and toughness, even with large dimensions: very high
- > Wear Resistance: good
- > Compressive strength: high
- > Dimensional stability: very high
- > Excellent homogeneity and isotropy: very high
- > Fine carbide structure: very high
- > Homogeneous microstructure: very high

## Applications

- > Machine knife (for producers)
- > Coining
- > General Components for Mechanical Engineering
- > Fine Blanking, Stamping, Blanking
- > Rolling
- > Powder Pressing
- > Components for Recycling Industry
- > Cold Forming
- > Wear parts
- > Pill punching dies

## Chemical composition (wt. %)

C	Si	Mn	Cr	Mo	V	W	Co
0.85	0.55	0.4	4.35	2.8	2.1	2.55	4.5

### Material characteristics

	Compressive strength	Dimensional stability during heat treatment	Toughness	Wear resistance abrasive	Wear resistance adhesive
<b>BÖHLER K890</b> MICROCLEAN™	★★★★	★★★★★	★★★★★	★★★	★★★
<b>BÖHLER K100</b>	★★	★★	★	★★★	★★
<b>BÖHLER K105</b>	★★	★★	★	★★	★★
<b>BÖHLER K107</b>	★★	★★	★	★★★	★★
<b>BÖHLER K110</b>	★★	★★★	★	★★★	★★
<b>BÖHLER K190</b> MICROCLEAN™	★★★★	★★★★★	★★★★	★★★★	★★★★
<b>BÖHLER K294</b> MICROCLEAN™	★★★★★	★★★★★	★★★	★★★★★	★★★★★
<b>BÖHLER K340</b> ISODUR™	★★★	★★★★	★★★	★★★	★★★★
<b>BÖHLER K340</b> ECOSTAR™	★★★	★★★	★★	★★	★★
<b>BÖHLER K360</b> ISODUR™	★★★	★★★★	★★★	★★★★	★★★★
<b>BÖHLER K346</b>	★★★	★★★	★★★	★★★★	★★
<b>BÖHLER K353</b>	★★	★★★	★★	★★	★★
<b>BÖHLER K390</b> MICROCLEAN™	★★★★★	★★★★★	★★★★	★★★★★	★★★★★
<b>BÖHLER K490</b> MICROCLEAN™	★★★★	★★★★★	★★★★	★★★★	★★★★
<b>BÖHLER K497</b> MICROCLEAN™	★★★★★	★★★★★	★★★	★★★★★	★★★★★

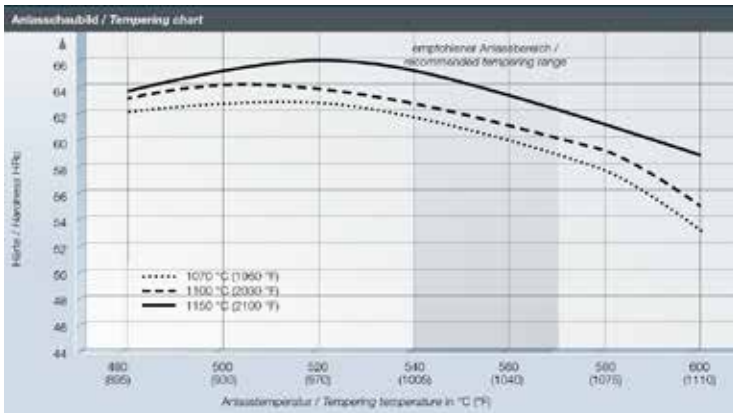
### Delivery condition

Annealed	
Hardness	max. 280 HB

### Heat treatment

Soft annealing		
Temperature (°C   °F)	650   1202 to 700   1292	Depending on the application, hardness can be adjusted by using specialized annealing treatment.
Stress relieving		
Temperature (°C   °F)	650   1202 to 700   1292	After through-heating, soak for 1 to 2 hours in a neutral atmosphere. Slow cooling in furnace.
Hardening and Tempering		
Temperature (°C   °F)	1070   1958 to 1150   2102	Following temperature equalisation: 20-30 minutes for a hardening temperature of 1070 - 1100 °C (1960 - 2010 °F) 6 minutes for a hardening temperature of 1150 °C (2100 °F) After hardening, tempering to the desired working hardness, see tempering chart.

## Tempering chart



### Tempering:

Hardening temperature:  
 ••• 1070°C/1960°F  
 - - - 1100°C/2030°F  
 ——— 1150°C/2100°F

Slow heating to tempering temperature immediately after hardening.

Dwell time in the oven 1 hour per 20 mm workpiece thickness, but at least 2 hours.

Slow cooling to room temperature after each tempering step is recommended.

Tempering at 540-570 °C at least three times is recommended.

Please refer to the tempering diagram for guide values for the achievable hardness after tempering. Tempering for stress relieving 30 to 50°C below the highest tempering temperature.

## Physical Properties

Temperature (°C   °F)	20   68
Density (kg/dm <sup>3</sup>   lb/in <sup>3</sup> )	7.85   0.28
Thermal conductivity (W/(m.K)   BTU (IT) ft/hr/ft <sup>2</sup> /F)	22.5   13
Specific heat (J/(kg.K)   BTU (IT) lb/F)	450   107.48
Spec. electrical resistance (Ohm.mm <sup>2</sup> /m   10 <sup>-4</sup> Ohm.inch <sup>2</sup> /ft)	0.5   2.36
Modulus of elasticity (10 <sup>3</sup> N/mm <sup>2</sup>   10 <sup>3</sup> ksi)	218   31.56

## Thermal Expansions

Temperature (°C   °F)	100   212	200   392	300   572	400   752	500   932	600   1112	700   1292
Thermal expansion (10 <sup>-6</sup> m/(m.K)   10 <sup>-6</sup> inch/(inch.F))	10.5   5.833	11   6.111	11.3   6.278	11.7   6.5	12.1   6.722	12.4   6.889	12.9   7.167

For more information see [www.voestalpine.com/bohler-edelstahl](http://www.voestalpine.com/bohler-edelstahl)

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